

th2 — система с открытым исходным кодом для функционального тестирования финтех-систем под нагрузкой

Наталья Крюкова, th2, Exactpro



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about Exactpro



BUILD SOFTWARE TO TEST SOFTWARE

- Exactpro focus is software testing mission critical financial markets technology
- Headquartered in the UK with operations in the US, Russia and Georgia
- Our clients are regulated by the FCA, Bank of England and their counterparts from other countries
- Part of the London Stock Exchange Group (LSEG) from May 2015 until January 2018, when Exactpro management bought the company from LSEG
- Exactpro solutions are used in more than 20 countries all over the world
- Exactpro solutions are used by more than a half of top 20 exchange groups
- Incorporated on 9th September 2009 with 10 people, Exactpro now employs over 630 specialists



about Exactpro



Global Client Network

Amsterdam
Oslo
Stockholm
London
Zurich
Paris
Vienna
Milan
Madrid
Athens
Toronto
New York
Jersey City
Nur-Sultan
Tokyo
Osaka
Abu Dhabi
Hong Kong
Colombo
Lagos
Singapore
Johannesburg
São Paulo
Sydney

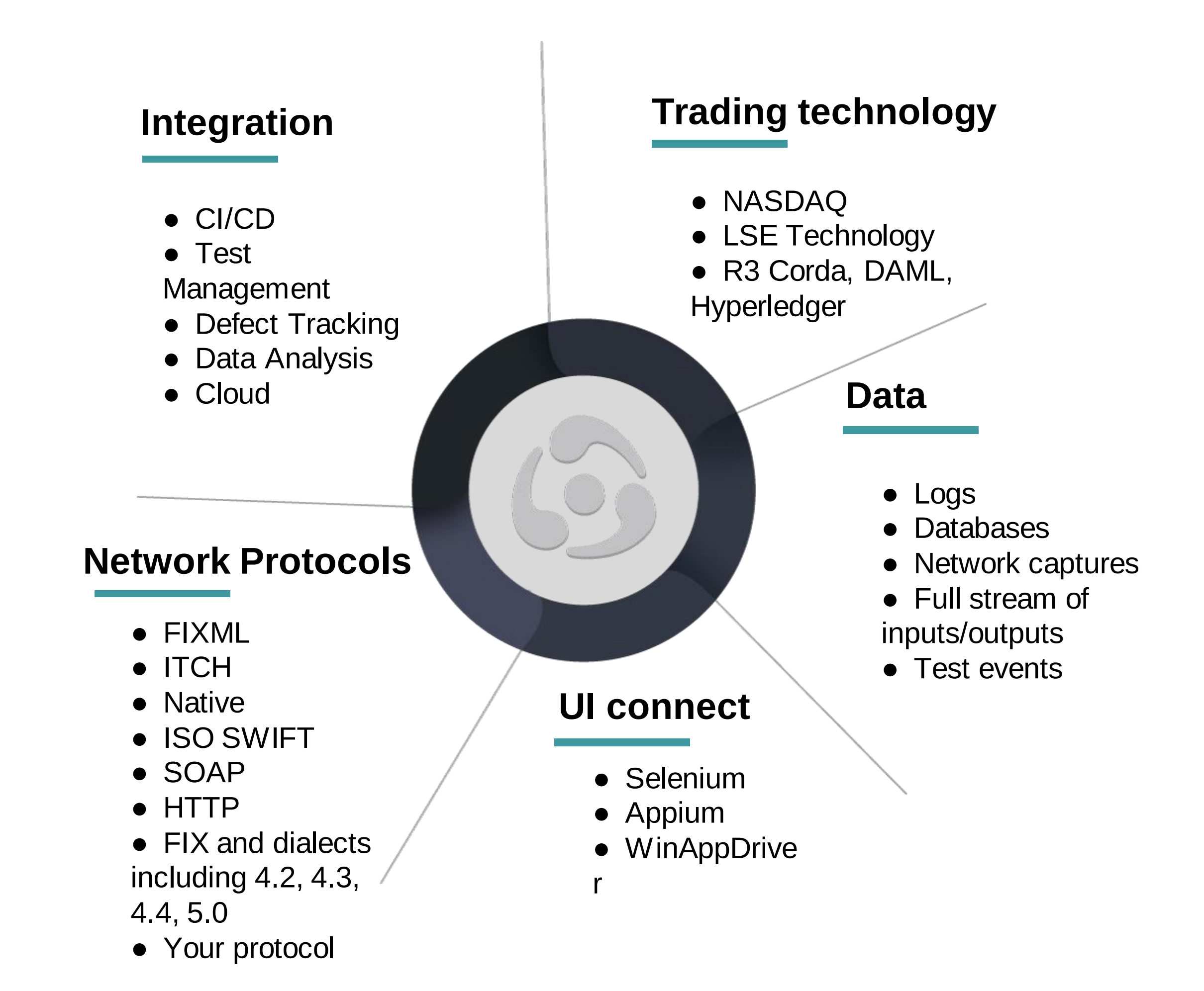
about th2



th2 is an open source toolkit for Software Development Engineers in Test.

th2 can be used to develop machine driven e2e test libraries for complex financial transaction processing system.





plan





why?

- fintech applications requirements
- test approach limitations

plan





why?

- fintech applications requirements
- test approach limitations

what?

- th2 and HiVAT paradigm

plan





why?

- fintech applications requirements
- test approach limitations

what?

- th2 and HiVAT paradigm

how?

- th2 architecture (th2-infra, th2-core)
- th2 use cases

fintech logic complexity



why?

Static Data

reference data setup, market control actions

functional correctness and execution efficiency

Liquidity Partners

Market Control

Dark & Algo-Crossing Book

Smart Order Router

Lit Markets

Connectivity, tags, order validation

Trading GWs

Lit Book

Heatmap

Client Brokerage Systems

Trading Desktops

matching rules, periods, order constrains and validity

Reference Pricing Server

Dark Markets

consolidated book

Market Data GWs

Distribution System

Market Data

Compare vs. execution reports

MIS

Surveillance System

Clearing GW

CCP

Persistence DWH & MIS

data, reports, recovery

Surveillance UI

alerts, patterns, book replay

post trade processing, reconciliations

Brokerage Back Office

CSD

Read

Operability, deployment, configuration, monitoring, fault-tolerance, disaster recovery

fintech technical capacity



why?

- Daily capacity – 300+ mln transactions
- Peakrates – 50k transactions per second per partition
- Average round-trip latency – <60 microseconds
- Availability – high nines

Year	Data Volume in zettabytes
2010	2
2011	5
2012	6.5
2013	9
2014	12.5
2015	15.5
2016	18
2017	26
2018	33
2019	41
2020	59
2021	74
2022	94
2023	118
2024	149

test approach - functional logic







Web

Binary

FIX

Sailfish TESTING TOOL

Market Data

Database

Expected results FIX	Actual results FIX

Expected results Market Data	Actual results Market Data

Expected results DataBase	Actual results DataBase

test approach - technical capacity



why?

FIX
LSE
SOAP
Native
ITCH
HTTP
SOLA SAIL
& HSVF
Your protocol

the case



why?

throttling

batching issues

deadlocks

the case



why?

throttling **batching issues** **deadlocks**

Production ?

the case



why?

throttling **batching issues** **deadlocks**

Pr[illegible]on?

DANGER

Facebook IPO

high load **just one cancel** **cross book**

the case



why?

throttling **batching issues** **deadlocks**

Pr… …on?

DANGER

Facebook IPO

high load **just one cancel** **cross book**

no trading for 30 min



$10m+ penalties

FINES

the case



why?

Functional Testing

Non-Functional Testing

? ? ? ? ? ?

the in-between



what?

Functional Testing

Non-Functional Testing

next-generation test tool



what?

Modularity

Configuration Agility

Data Analysis

Diversity

Resilience

Scalability

th2



how?

Modularity

Configuration Agility

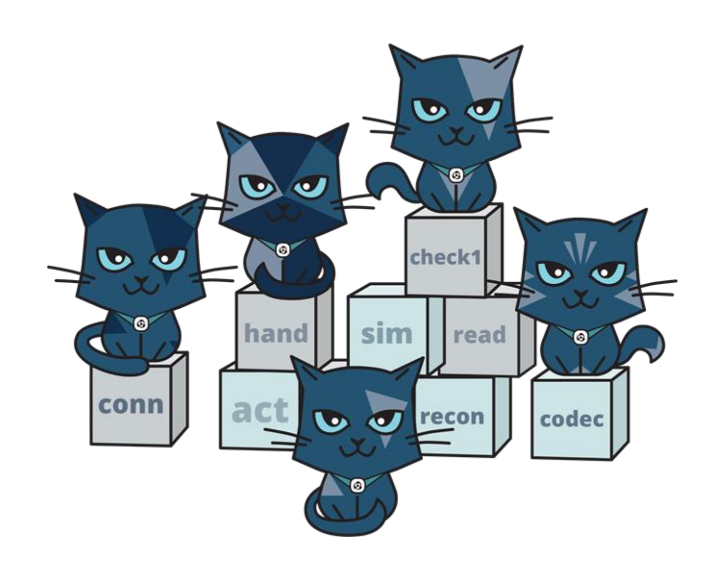
Data Analysis

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th2





how?

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Scalability

th2
CUSTOM
act
check2
sim
Tests

th2
PREPARED BUILDING BLOCKS
codec
conn
read
hand

System Under Test

th2
CORE
check1
estore
mstore
storage
data
viewers

th2
DATA SERVICES

th2 - infra



how?

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DATA SERVICES

th2 - infra



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Modularity

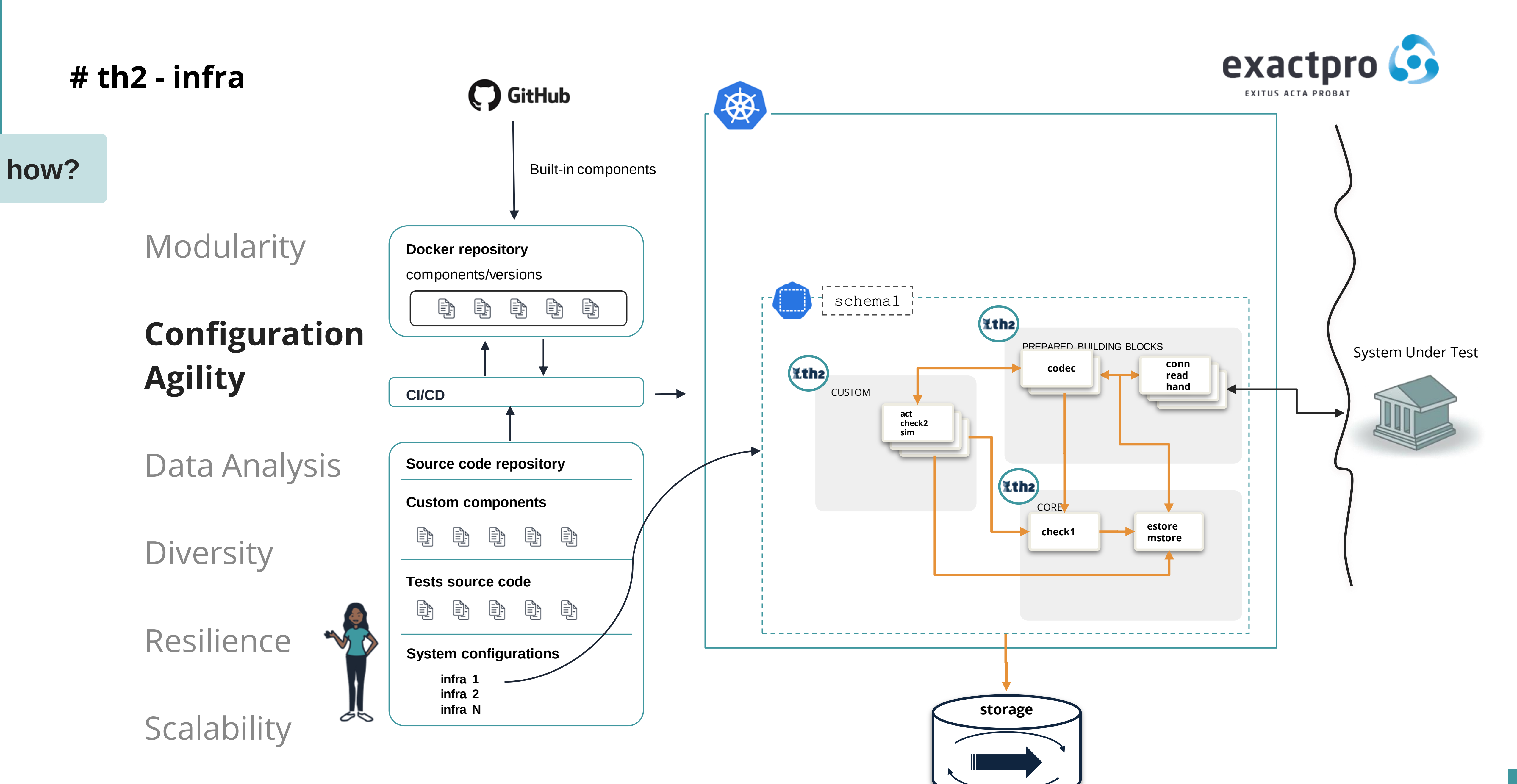
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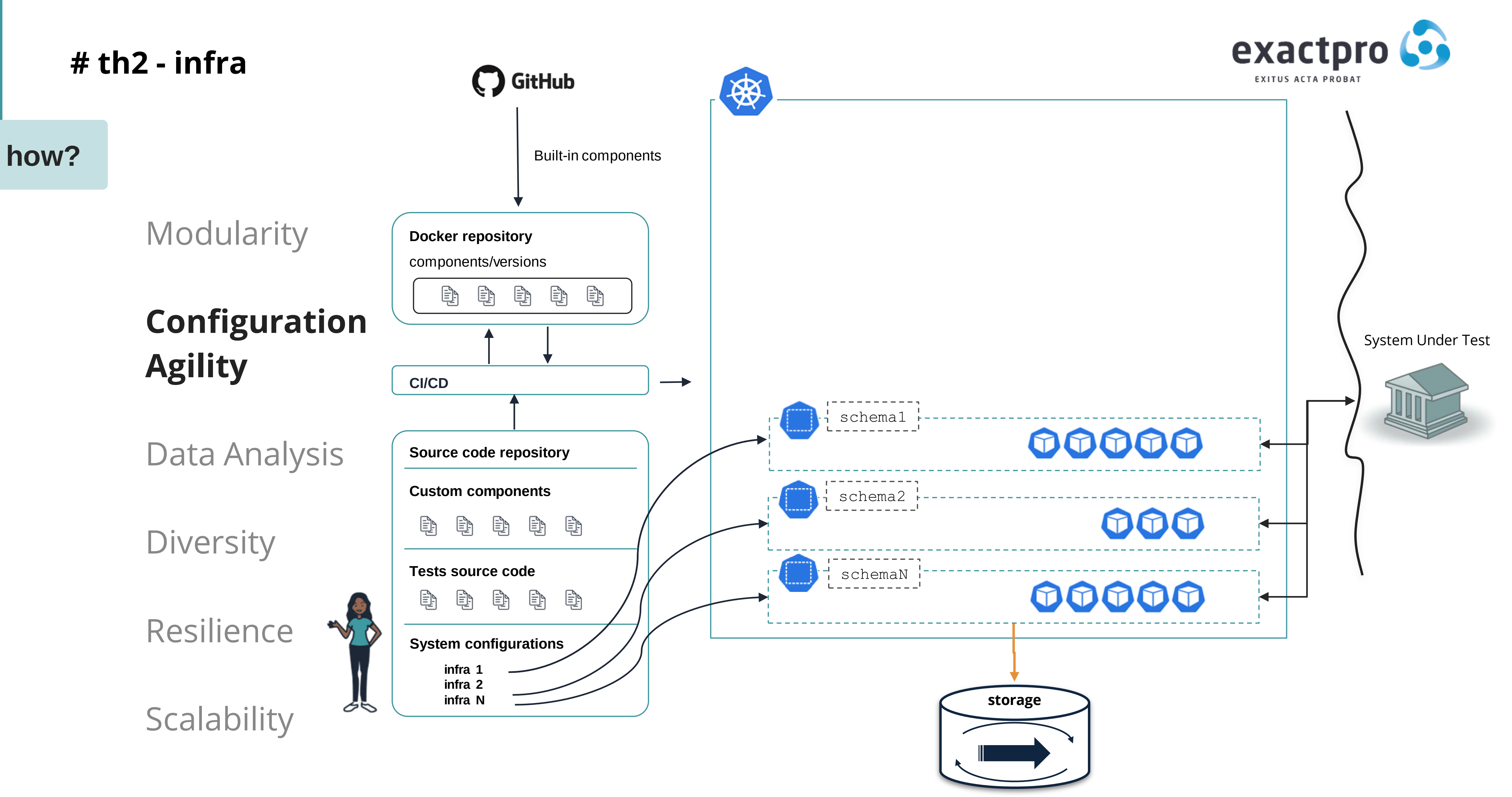
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Scalability

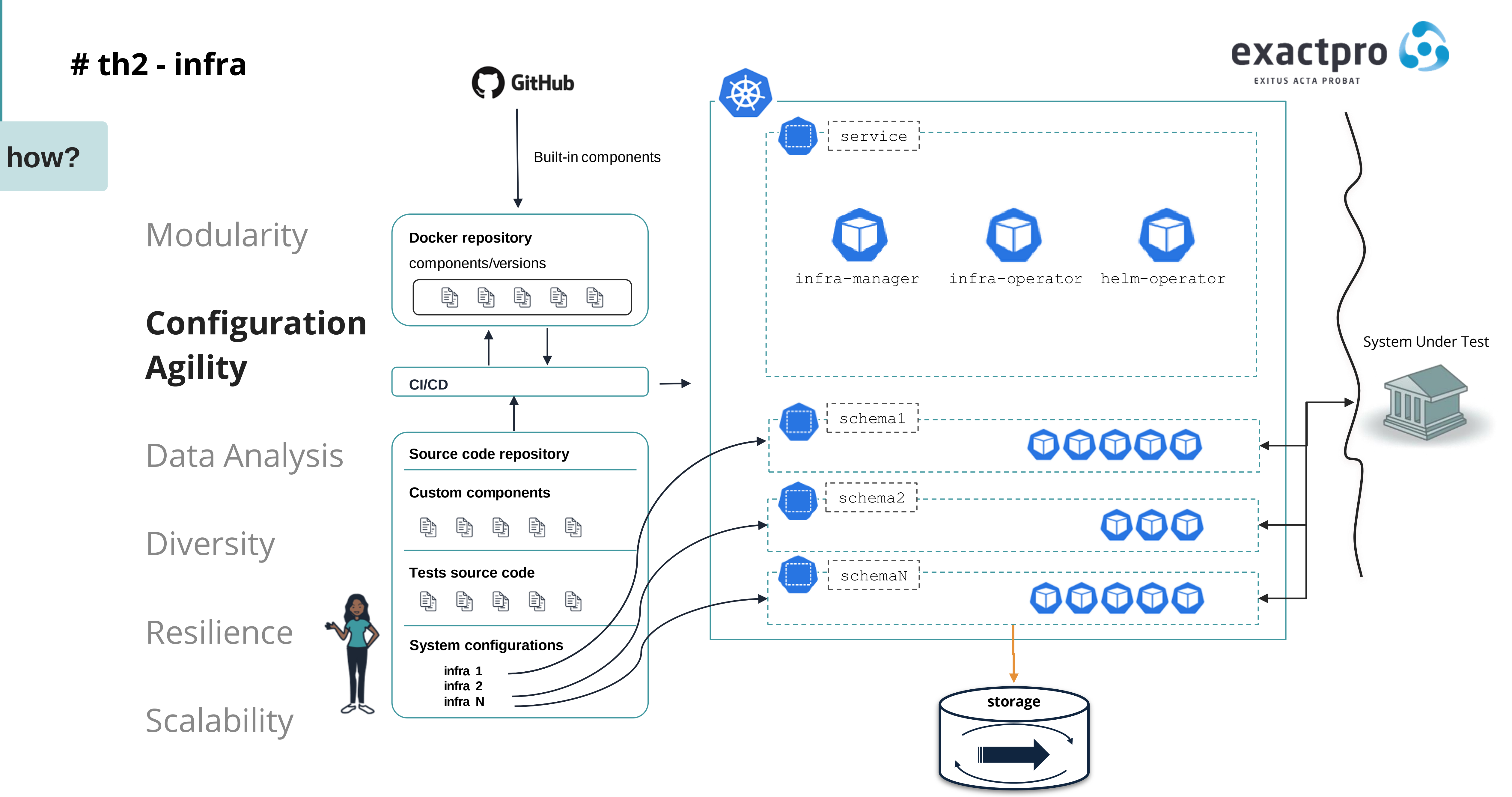


th2 - infra
how?
Modularity
Configuration
Agility
Data Analysis
Diversity
Resilience
Scalability
GitHub
Built-in components
Docker repository
components/versions
CI/CD
Source code repository
Custom components
Tests source code
System configurations
infra 1
infra 2
infra N
schema1
th2
PREPARED BUILDING BLOCKS
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System Under Test
exactpro
EXITUS ACTA PROBAT

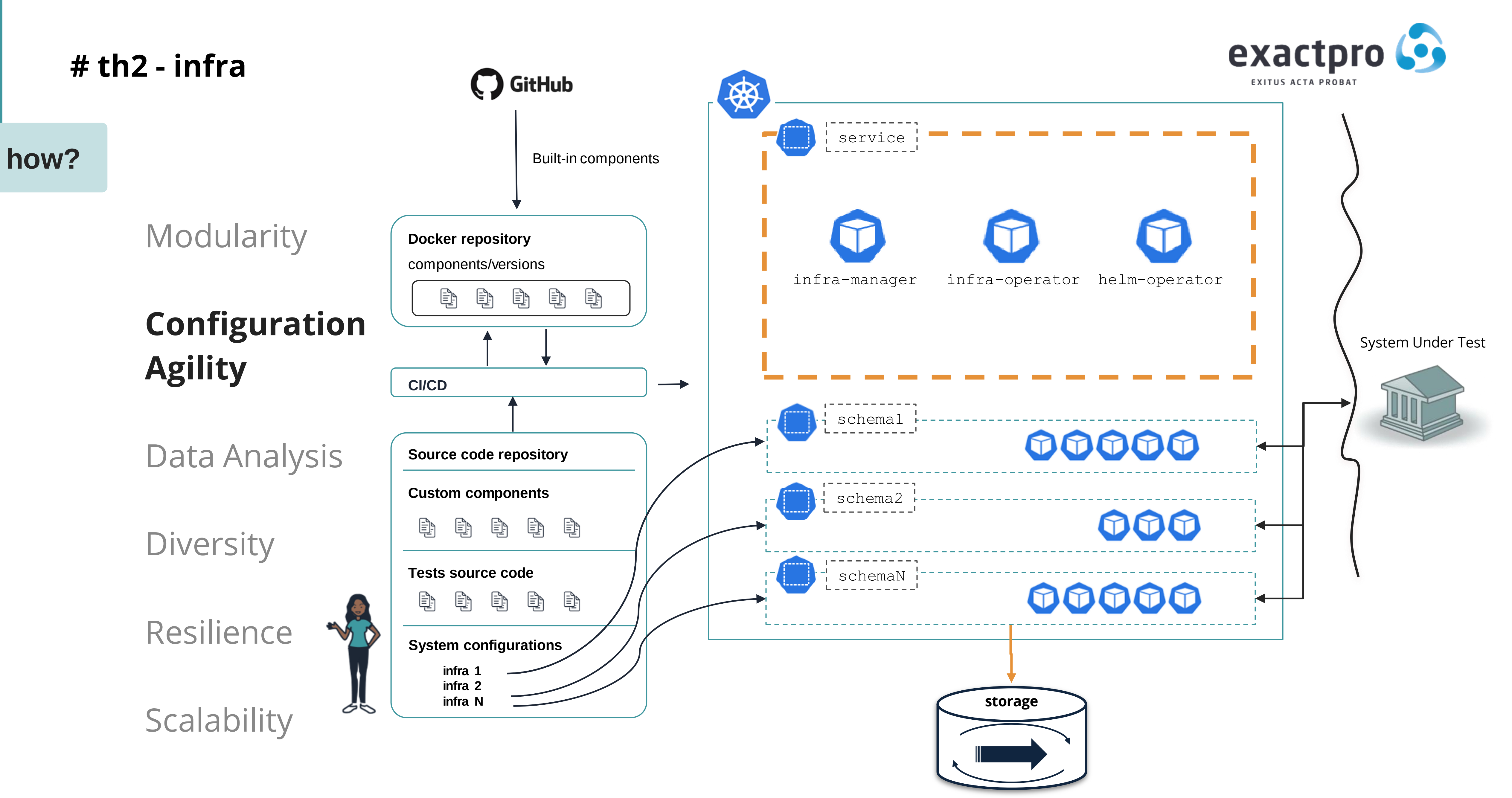
th2 - infra



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th2 - infra
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System configurations
infra 1
infra 2
infra N
service
infra-manager
infra-operator
helm-operator
schema1
schema2
schemaN
storage
System Under Test
exactpro
EXITUS ACTA PROBAT



th2 - infra
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EXITUS ACTA PROBAT

th2 - infra



how?

Modularity

Configuration Agility

Data Analysis

Diversity

Resilience

Scalability

infra git
service
infra
infra-manager
infra-operator
helm-operator
schemaN
th2 custom resources
helm release
System Under Test

th2 - infra



how?

Modularity

Configuration Agility

Data Analysis

Diversity

Resilience

Scalability

Provide access to k8s cluster

Create Rabbitmq and Cassandra users with appropriate permissions

Create namespace

Create secrets

Encode Dictionary into base64 for ConfigMap

Create ConfigMaps with RabbitMQ credentials, GRPC settings, Queues and etc

Create Service

Create Deployment

Create Ingress



th2-infra deploy via Helm

Create a branch in Git repository

th2 infra magic

Create th2 Custom Resources in the branch

th2 infra magic

th2 - core





how?

Modularity

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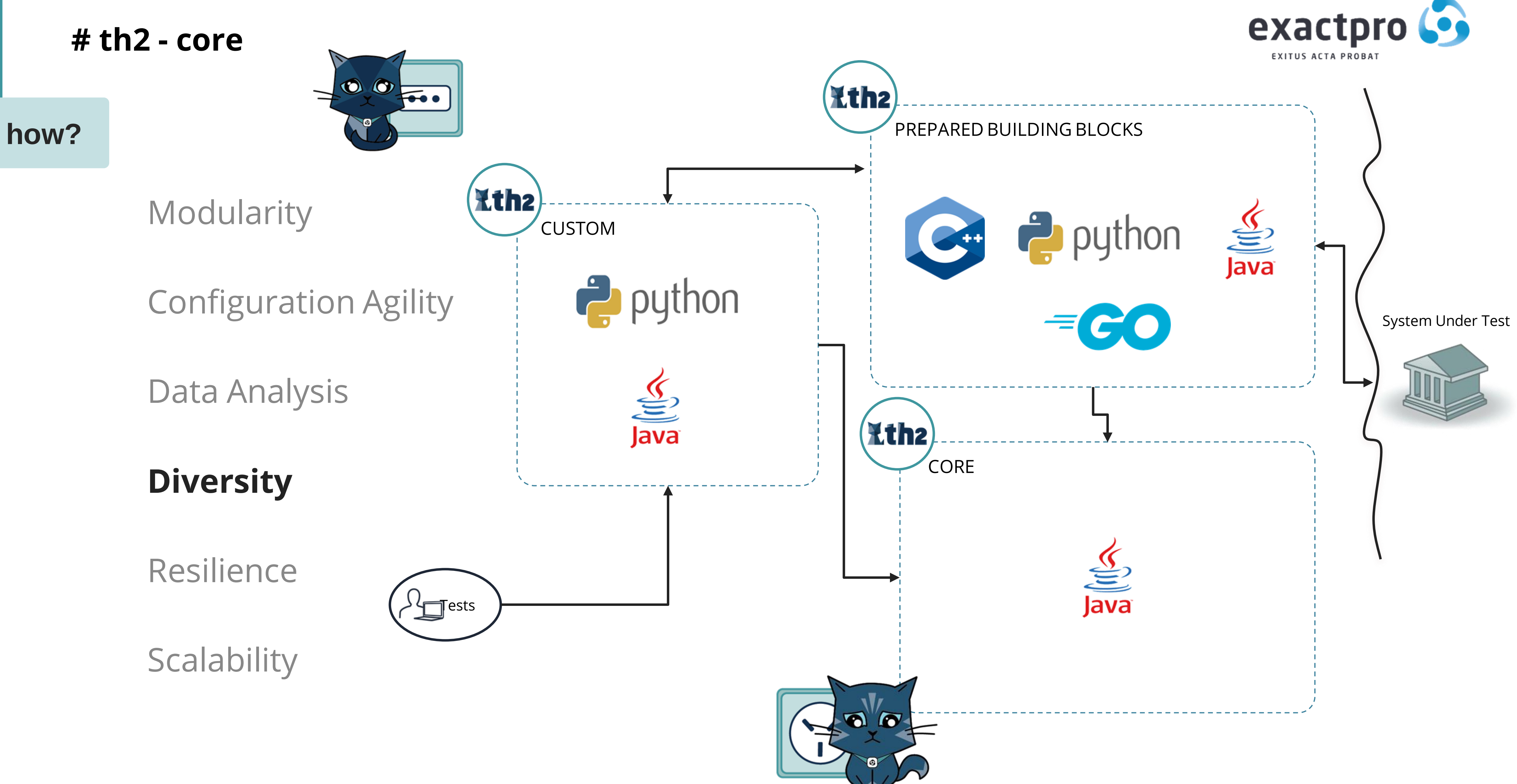
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mstore
data
viewers
cassandra
th2 API
System Under Test
RStudio
jupyter
tableau
Apache Zeppelin

th2 - core

how?


exactpro
EXITUS ACTA PROBAT
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PREPARED BUILDING BLOCKS
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GO
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th2 - core



how?

Modularity

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th2 - R3



how?

Modularity

Configuration Agility

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Diversity

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th2 - core





Modularity

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how?

Modularity

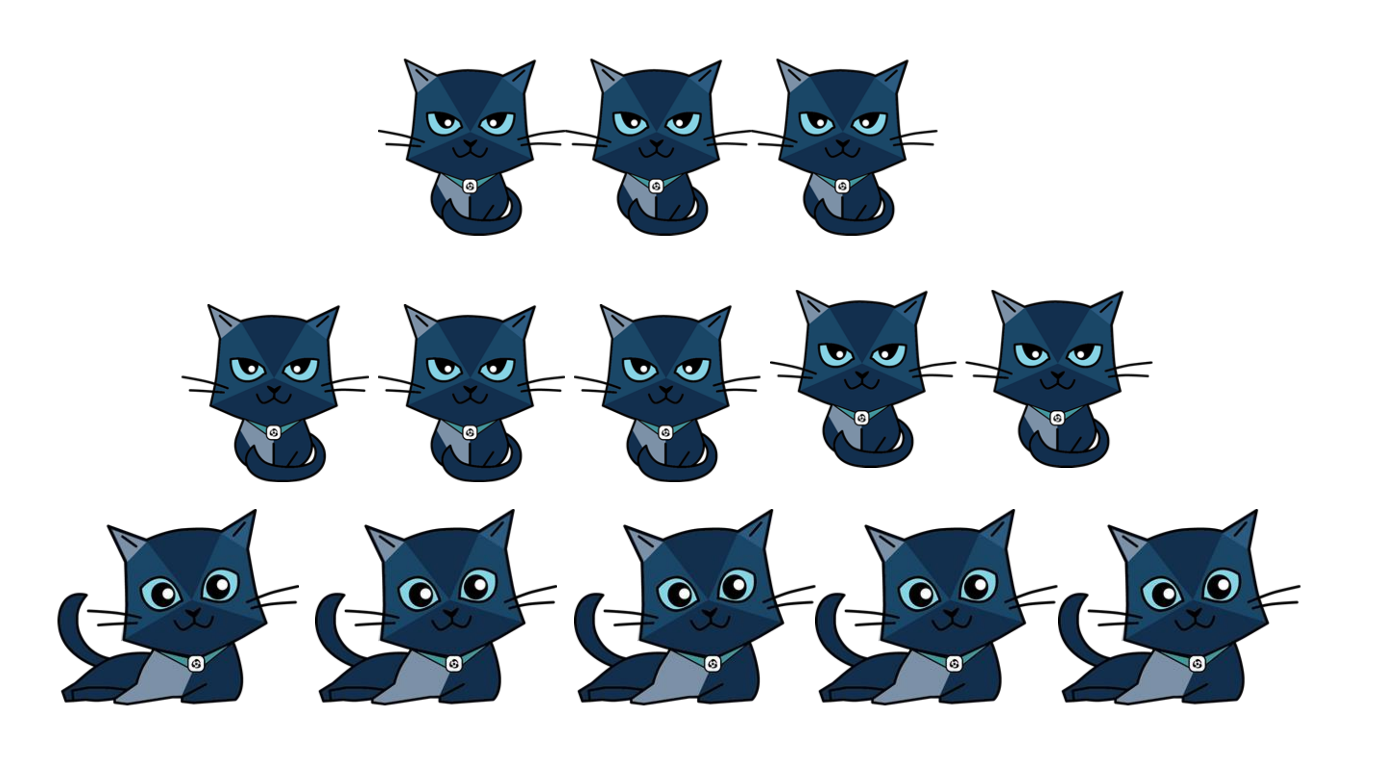
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lessons learned



how?

MQ

- any connection may be blocked if the memory limit is exceeded
- durable queues require active consumers if there are no limits set

th2 architecture

- awaiting for unnecessary confirmation may cause serious slowdowns
- real-time processing time isn't necessary if the whole data stream is already stored
- stream processing works better for heavy operations
- Kubernetes informer API is more reliable than plain watch api

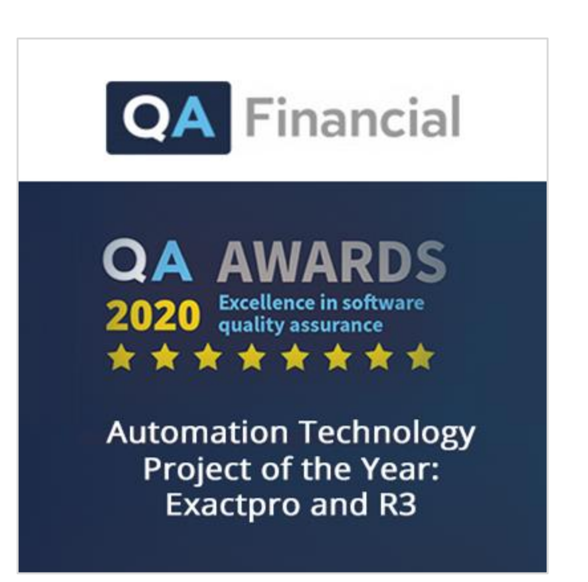
open-source registry / repository

- cloud services are not eternal

Thank You











th2 is available in GitHub!

th2 is a Kubernetes-driven microservices solution tailor-made to deliver efficient machine-driven end-to-end test libraries with comprehensive coverage of your system. th2 consolidates the power of the entire Exactpro test tool suite in a single solution.



FIND OUT MORE ABOUT TH2

